CHAPTER – V

SUMMARY AND CONCLUSIONS

The present investigation involves the development of new adsorbents for the efficient removal of dyes from textile effluents. Literature review shows that the treatment of textile effluent in chemical treatment methods produces secondary by-products which are also harmful to humans and other living organisms. On other hand adsorption process removes the dyes and other pollutants from the effluents without producing secondary products. Several adsorbents have been already studied for the removal of dyes and other pollutants from industrial effluents, activated carbon, metal oxides and low-cost adsorbents such carbon derived from agricultural wastes are reported to be efficient in the removal of many pollutants.

Synthetic adsorbents are not much in practice because of their relatively high cost. Researchers are interested in the development of reusable of adsorbents with high adsorption capacity since it reduces the cost of the treatment process. Polymeric adsorbents have emerged as alternatives to traditional adsorbents because of their vast surface area, adjustable surface chemistry and feasible regeneration under mild conditions. Among the factionalized polymers polyaniline got more importance because of its stability and ease of preparation. Hence, in this view, polyaniline modified composites of metal oxides such as Al₂O₃, Fe₃O₄, Co₃O₄ and NiO were prepared in a simple in situ chemical polymerisation method. Metal oxides
Fe₃O₄, Co₃O₄ and NiO were chosen because of their magnetic property which will be helpful in the separation of adsorbent from the effluent after the treatment.

Alumina (Al₂O₃) is a well-known and most used synthetic adsorbent, hence polyaniline modified alumina has been prepared for comparison with other metal oxide adsorbents.

The activities of as synthesised metal oxides and polyaniline modified metal oxides were evaluated for the removal of three anionic dyes Reactive Blue 160, Reactive Yellow 84 and Reactive Red 120. The results show polyaniline modification increases the adsorption capacity of the all the adsorbents from 1.5 to 2 times of their original adsorption capacity.

Among the four adsorbents studied, PANI-Fe₃O₄ composites have highest equilibrium adsorption capacity (203 mg g⁻¹) for the removal of anionic dyes and also PANI-Fe₃O₄ has a good reusability. The material removes the dyes without any significant loss in the activity even after five cycles. PANI-Co₃O₄ composites also have higher adsorption capacity (143 mg g⁻¹) than PANI-Alumina composites (132.6 mg g⁻¹).

Adsorption of dyes on all the materials follows pseudo second order kinetics and the equilibrium data fitted well in Langmuir adsorption model with good regression coefficient. The adsorption of anionic dyes on all PANI modified adsorbents are pH dependent, their activities are more in acidic pH. The adsorption of the dyes was very poor in alkaline pH. This shows that the
dyes anionic dyes are adsorbed on the PANI modified adsorbent due to electrostatic attraction.

Further the studies show that the exhausted adsorbents can be easily regenerated by treating with 0.05M NaOH solution. Based on the adsorption capacity and reusability the PANI-Fe$_3$O$_4$ is a good adsorbent for the removal of dyes from waste water.